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The Bomb's Chicago fallout

U.S. says '40s research put thousands at high risk

By Sam Roe
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TRIBUNE STAFF WRITERS

Herbert Anderson was a major figure in the race for the atomic bomb, a pioneering physicist who made history at the University of Chicago in 1942 when he helped create the world's first controlled nuclear chain reaction.

But Anderson paid a heavy price for such achievements.

He contracted a rare lung disease from handling beryllium, an extraordinarily toxic metal critical to nuclear weapons production. Before he died, his lungs were so damaged he couldn't breathe without an oxygen tank, and his bones were so brittle he once broke two fingers just by shaking someone's hand.

Now, more than a half-century after the dawn of the nuclear age, America is beginning to get a glimpse of how thousands of scientists and ordinary laborers—many in the Chicago area—may have risked their lives to develop and build the country's nuclear arsenal.

In an unprecedented move, the federal government last month released a list of 317 mills, factories and research institutions that it believes may have exposed workers to toxic and radioactive materials during nuclear weapons production or in work for the Department of Energy.

Fifteen sites are in Chicago—more than any other U.S. city—and a total of 24 are in the Chicago area. They range from the secret wartime headquarters of atomic bomb research at the U. of C. to factories, machine shops and storage sites far beyond the university gates.

At a West Chicago factory thousands of workers breathed air laced with the radioactive metal thorium; at the Museum of Science and Industry, radioactive materials were stored—and spilled—in the early years of the Cold War; and at the U. of C., at least 10 workers became sick after being exposed to beryllium at a clandestine lab code-named Site B.

"There's been so much secrecy and denial in the history of the nuclear weapons complex that just getting this information out is of his-

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Tribune photo by John Kringas

Larry Kelman, 81, who has beryllium disease, sorts through clothes that no longer fit him. On the wall is a picture of him at 23, around the time he joined the Manhattan Project.

Health risks of elements used in nuclear weapons research

Several Chicago-area facilities handled these hazardous materials during World War II and the decades that followed:

BERYLLIUM

Beryllium is an extremely lightweight metal that is six times stiffer than steel. It often is used in industrial manufacturing, especially in aerospace and defense, and also in nuclear reactors. It is very brittle, and its dust and fumes are toxic.

Effects of exposure

Even tiny amounts can cause chronic beryllium disease, a treatable but often fatal lung condition. Beryllium also can affect the liver, kidneys and heart. Symptoms might not appear for years after exposure.

URANIUM

Uranium, a radioactive metal, is the main fuel for nuclear reactors and the principal building block in nuclear weapons. Many minerals contain uranium; it is converted to metal by chemical processing.

Effects of exposure

Uranium poses increased risk of lung and bone cancers if it is inhaled or ingested. It is toxic at high concentrations and can damage the kidneys and other organs. Studies suggest it might also affect reproduction.

THORIUM

Thorium, a natural ore mined from the Earth's crust, is a radioactive, crystalline powder. It is valued as a fuel for nuclear reactors, where it can be converted to uranium.

Effects of exposure

Radioactive materials can damage DNA in cells, increasing the risk of some cancers. Thorium has been linked with an increase in liver cancer and leukemia.

Source: U.S. Department of Energy, Concise Encyclopedia of Science and Technology, Institute for Energy and Environmental Research



Tribune file photo

A worker at the Metallurgical Laboratory at the University of Chicago in 1946.



Despite tests (left) for radioactive contamination, more than 8,000 workers nationwide may have been harmed in nuclear weapons research in the 1940s.

Developing nuclear arsenal put thousands of lives at risk

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toric importance," said David Michaels, who was the Energy Department's top health official in the Clinton administration.

The government estimates that more than 8,000 workers nationwide may have been harmed. But no one knows every facility where workers were injured or how serious the hazards were.

While nuclear weapons-related work continues in other parts of the nation, Chicago's ties to the industry have dropped. In fact, few Chicago-area companies on the government's nuclear weapons list were involved after 1960, and about half no longer exist.

At some sites, it appears the risks were slight. Government records indicate that relatively little radioactive material was stored at the Museum of Science and Industry, and two radiological surveys have revealed no lasting contamination.

But the dangerous work done at other facilities offers ample reason for concern. At least two scientists, including Anderson, died of beryllium disease after doing wartime research at the U. of C.

"The government really ruined the lives of many people," said Larry Kelman, 81, a Naperville resident who developed beryllium disease after working at Site B.

Groundbreaking effort

For decades the federal government denied that workers were being harmed by nuclear weapons production. But in 1999, the government admitted for the first time that weapons work had caused illnesses, and Congress approved a program to provide victims with government-paid medical care plus \$150,000 in compensation. The re-

tan Project workers wore respirators—a common safeguard today.

One scientist who worked with beryllium was Anderson, who did wartime research involving the metal at Columbia University in New York and at the U. of C. In 1942, he and about 40 other scientists, including Nobel Prize winner Enrico Fermi, gathered at a makeshift laboratory at the U. of C.'s Stagg athletic field and produced the first self-sustained nuclear chain reaction. The event helped usher in the nuclear age and paved the way for a vast nuclear weapons industry.

Anderson's widow, Betsy, recalled how her husband used a mortar and pestle to grind beryllium like flour. "He would just sort of grind it up by hand and be breathing the dust," she said.

It wasn't until 1948 that Anderson noticed he was losing weight and becoming easily winded. At 34 years old, he was told he had beryllium disease. Steroids stabilized his condition, and he went on to enjoy a long career as a researcher and U. of C. physics professor.

But in his final few years, his lungs deteriorated to the point where he needed to carry a portable oxygen tank wherever he went. Side effects from the steroids made his bones as fragile as glass.

"He began to break ribs when he coughed badly," said his wife, a retired physics research technician in Santa Fe. "One time someone shook his hand and broke a couple of his fingers." He died in 1988 at age 74.

"The last year before his death, he was never getting enough air. It was this very labored gasping," his wife said. "It was a lot like strangling slowly."

Lower-profile workers faced similar risks—and harm.

Kelman joined the Manhattan

C., alleging that he was not warned of beryllium's dangers and that his condition was not detected earlier.

But a judge threw out the suit, ruling Kelman did not demonstrate enough evidence of wrongdoing for the court to allow the case to go to trial. Kelman did receive \$15,000 in a worker's compensation settlement and about \$45,000 in medical expenses, according to the university.

At least 10 workers developed beryllium disease after working at Site B, Argonne reports. But Argonne, citing state laws governing the privacy of medical records, would not release the names of the victims or details of their illnesses.

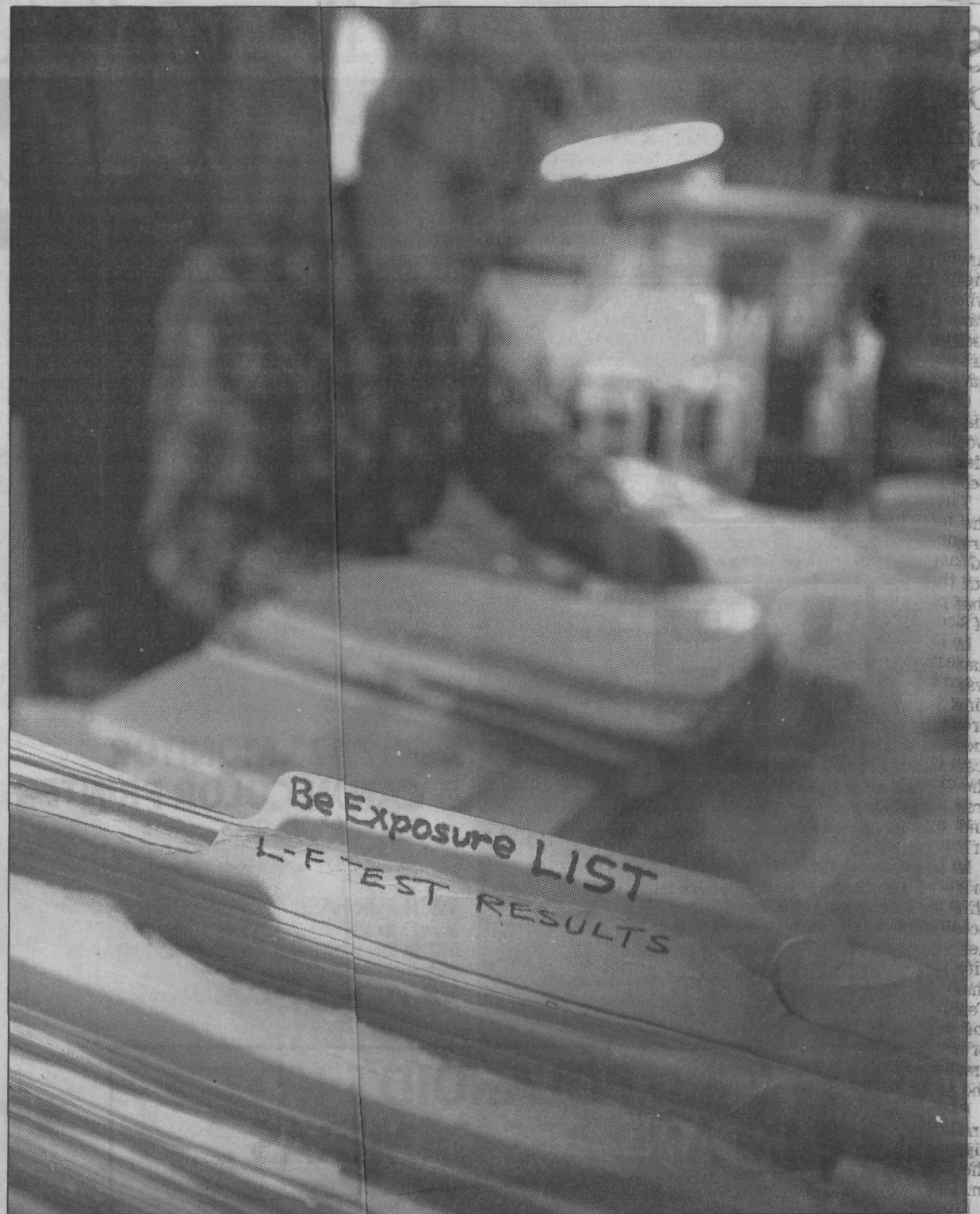
Kelman, who retired from Argonne in 1989 as a senior metallurgist, acknowledged he is lucky. He shows few visible signs of beryllium disease and still drives, gardens and travels with his wife—even shovels snow.

But he said he has a bad cough and has lived for years with the knowledge that he has a potentially fatal disease. "It's there and it will always be there," he said.

Site B no longer poses a health problem. It was torn down more than 25 years ago, and "all underground piping and structure removed to a minimum depth of 4 feet," an Energy Department document states.

Exposed to thorium

Beryllium is not the only potentially hazardous material that qualified facilities for the government list. For decades, a West Chicago plant originally owned by Lindsay Light and Chemical Co. exposed thousands of workers and West Chicago residents to thorium, a radioactive element that helps fuel nuclear reactors and nuclear bombs.



Tribune photo by John Krings

Larry Kelman of Naperville looks through files he has kept on beryllium disease. He sued the University of Chicago over his exposure to beryllium. The suit was thrown out, but he did receive a settlement.

Area facilities associated with nuclear weapons work or energy research

The U.S. Department of Energy has identified the following facilities as having handled beryllium or radioactive materials at least once over the last 60 years in the course of nuclear weapons production or in work for the department.

- **Argonne National Laboratory (near Lemont)**
Created in 1946, Argonne is the civilian successor to the University of Chicago's Metallurgical Laboratory and Manhattan Project operation. After the war, work at Argonne shifted from weapons development to nuclear energy. But workers still handled radioactive materials and hazardous beryllium.
- **Armour Research Foundation (Chicago)**
Operated a research reactor for the Atomic Energy Commission. Government records indicate the trou-

- **Lindsay Light and Chemical Co. (West Chicago)**
Lindsay was the government's main source of radioactive thorium for reactors and weapons, producing 11.7 million pounds of the purified element for the Atomic Energy Commission from 1945 to 1963. Environmental cleanup of the site is still ongoing.

- **Midwest Manufacturing Co. (Galesburg)**
In 1944, Midwest did uranium foundry work (melting and casting) for the Metallurgical Laboratory, according to the Energy Department. It also did aluminum jacketing of

cently released list of weapons-related sites is the latest step in that groundbreaking effort.

Taken together with other government documents and interviews, the list opens a window on Chicago's historic role in the nuclear weapons industry and hints at the hazards that faced thousands of area workers, including machinists, welders, millwrights and engineers.

Their work was ordinary—grinding, sawing, sanding—but the use of exotic metals such as uranium and beryllium was not.

"Nuclear weapons production is largely this industrial process that looks like a lot of other industrial processes—it just uses some really weird materials," said Josh Silverman, a research analyst and historian for the Energy Department and an expert on nuclear weapons production.

Silverman said the main reason Chicago had so many firms doing weapons work was the proximity of the U. of C., where researchers with the top-secret Manhattan Project led the nation's World War II effort to build an atomic bomb.

According to press accounts at the time, 5,000 scientists helped develop the bomb at the university; another 3,000 local skilled and unskilled workers pitched in.

Risks of beryllium

To make the government's weapons list, a facility had to handle beryllium or a radioactive material such as uranium only once in the course of nuclear weapons production or in work for the Energy Department.

Beryllium is the hazard that researchers can most easily tie to weapons production. More than 300 people have contracted beryllium disease at facilities doing weapons work, government and industry documents show.

Lighter than aluminum but stiffer than steel, beryllium is used to amplify the chain reaction in a nuclear bomb. In bulk form the metal is relatively harmless. But when workers grind, sand or cut it and inhale the resulting dust, they can develop an incurable disease that slowly eats away at their lungs. A third die of the illness, a third become disabled and a third remain relatively healthy, doctors say.

Back in the mid-1940s, researchers knew beryllium dust was deadly, but they did not fully understand that microscopic particles could be harmful or that workers could become sick years after their last exposure. Consequently, few Manhat-



Tribune file photo

A sign from the 1940s at the University of Chicago warns Manhattan Project workers of the dangers of overexposure.

Project in 1944 as a 24-year-old metallurgist at the U. of C.'s "Metallurgical Laboratory," the name for several university facilities doing bomb research. He was assigned to Site B, a warehouse-turned-clandestine lab on University Avenue near 61st Street. He spent five years at the lab, testing a variety of metals, including beryllium.

Site B, he said, was always filthy. Barrels of debris were left open, beads of mercury collected in the cracks of the wood floors, and gray dust settled on tabletops.

"The secretaries would have to wipe the dust off the bosses' desks before they came to work," Kelman said. "If anyone would have come for a visit, they would have left thinking, 'What the hell is that place?'"

In 1948, as the U. of C.'s wartime research labs were evolving into the Argonne National Laboratory near Lemont, an Argonne doctor visiting Site B noted "rather distressingly poor housekeeping conditions" related to the handling of beryllium, graphite and mercury, according to an Argonne document.

Several months later, another Argonne physician found "an alarmingly dangerous situation concerning the use by at least six men of beryllium oxide powder with no precautions in an open room." Subsequent tests found beryllium dust in much of the building, including the attic.

By 1953 Argonne had identified 192 workers associated with the Metallurgical Laboratory or Argonne who had been exposed to beryllium. Kelman estimates there were dozens more: "Anybody that got into [Site B] was exposed: salespeople, the guard at the door, janitors."

In 1980 Kelman was told he had beryllium disease. He sued the U. of

Use of the metal was a closely guarded secret. During World War II, it even carried a code name, "Penbarnite."

From 1945 to 1963, the West Chicago plant was the main source of thorium for the government weapons program, according to a 1997 Energy Department report. The report cited company records showing that Lindsay Light and its successor, American Potash, sold 11.7 million pounds of purified thorium for use in reactors or weapons.

Only after the plant closed in 1973 did federal officials discover the extent of medical and environmental effects from the operation.

A 1980 study of more than 3,000 workers at the plant showed somewhat elevated rates of death from cancer, especially lung cancer. Argonne researcher Andrew Stehney also examined autopsy results of former plant workers. One 23-year veteran of the facility had thorium concentrations 6,000 times higher than normal in his lungs and lymph nodes. The man had died of pancreatic cancer.

Waste and leftover thorium ore from the plant have created a health hazard that still affects local residents. Operating at a time before stringent regulation of radioactive materials, the plant trucked the sandy thorium waste to ordinary dumps or let people take it away for use as landfill.

More than 600 homes near the plant have been targeted for cleanup since the mid-1990s, said officials at Kerr-McGee Chemical LLC, which bought the West Chicago plant in 1967. At last count, Kerr-McGee had shipped nearly 1 million tons of contaminated soil from West Chicago to a dump in Utah.

Others on the list

At other area weapons-related sites, the record on potential health risks is less clear.

In 1943 Fansteel Metallurgical Corp. of North Chicago obtained a \$44,200 contract to provide 720 beryllium bricks to the Manhattan Project. Government officials said Fansteel was still processing beryllium in 1944, but no one knows how long the work continued.

Michael Mocniak, vice president and general counsel for Fansteel, said he had not known the company had ever done work with the highly hazardous metal. The company has changed locations since the war, and Mocniak said he does not know where the beryllium processing was done or what the building might be used for now.

At the Museum of Science and In-

dustry, current officials were surprised to learn that the museum provided storage space for radioactive materials during the Cold War.

A 1979 Energy Department report shows the museum was used for storage and office space by the Metallurgical Laboratory and Argonne from 1946 to 1953. The project took up more than 50,000 square feet, mostly in the East Pavilion.

Government records do not indicate the kind of radioactive materials involved. Workers interviewed for the 1979 report remembered at least one spill of radioactive material near a service elevator on the ground floor. The area was immediately decontaminated.

A survey by Argonne in 1949 found no trace of residual radioactive contamination, and neither did

may have been investigating chemical properties of uranium. The foundation had government contracts at least in the 1940s through '60s.

• Blockson Chemical Co. (Joliet)

Produced byproduct uranium from phosphate rock. Records show work lasted at least from 1954 to 1956.

• C-B Tool Products Co. (Chicago)

Subcontracted work for the Manhattan Project a U. of C. in 1944. Government officials believe the work may have involved machining of uranium.

• Crane Co. (Chicago)

Records show that in the late 1940s the company tested designs for valves, probably for use with radioactive material in reactors. May also have worked for nuclear weapons industry in the 1950s and 1960s.

• ERA Tool and Engineering Co. (Chicago)

From February to June 1944, ERA subcontracted to provide "supplies and services" to the U. of C. Metallurgical Laboratory. No further details available.

• Fansteel Metallurgical Corp. (North Chicago)

Contracted in 1943 to make 720 bricks of beryllium for the Manhattan Project. Records indicate the work lasted at least until 1944.

• Fermi National Accelerator Laboratory (Batavi)

Never involved in nuclear weapons work since its creation in 1968. The Department of Energy included Fermilab on its list because it is a DOE facility where workers handle beryllium and radioactive material.

• Great Lakes Carbon Corp. (Chicago)

Provided special graphite, which is used to control nuclear reactions, to the Atomic Energy Commission from 1952 to 1958. Records show the company also worked with a reactor fuel, possibly uranium, in 1958.

• GSA 39th Street Warehouse (Chicago)

Used to store radioactive materials for the Manhattan Project and other defense work from the 1940s to 1953.

• International Register (Chicago)

Used only once by the Metallurgical Laboratory in the early 1940s to conduct grinding experiments on uranium rods. Company has since changed its name to Intermatic Inc. and moved to Spring Grove.

• Kaiser Aluminum Corp. (Dolton)

Shaped uranium rods for Argonne National Laboratory in 1959.

Source: U.S. Department of Energy

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uranium slugs.

• Museum of Science and Industry (Chicago)

The U. of C.'s nuclear program occupied space at the museum from 1946 to 1953, mostly for overflow office space. Government records show there was some handling of radioactive materials at the museum. Radiation surveys conducted in 1949 and 1977 found normal levels.

• National Guard Armory (Chicago)

Manhattan Project and other defense projects used the site for storage and processing of uranium metal from 1942 to 1951. Located at 52nd Street and Cottage Grove Avenue. Cleanup of the property, now owned by the State of Illinois, was completed in 1988.

• Poddeliniac Corp. (Chicago)

Tested a uranium solution in 1957 for National Lead of Ohio, a weapons contractor.

• Precision Extrusion Co. (Bensenville)

Shaped pieces of uranium for Argonne National Laboratory from 1956 to 1959.

• Quality Hardware and Machine Co. (Chicago)

Provided tools, dyes and fixtures to the U. of C. in February 1944 under a government contract. The company produced experimental uranium fuel slugs in the summer of 1944.

• R. Krasburg and Sons Manufacturing Co. (Chicago)

From April to December 1944, Krasburg had a subcontract to provide "services and supplies" to the U. of C. Metallurgical Laboratory, according to DOE records. No further details available.

• Sciaky Brothers Inc. (Chicago)

Performed a one-time experiment in 1953 involving welding of uranium metal.

• University of Chicago (Chicago)

Original home of the Manhattan Project and site of world's first controlled nuclear chain reaction on Dec. 2, 1942. Researchers and laborers handled hazardous materials, such as beryllium and uranium. The university was chosen to run Argonne National Laboratory after World War II.

• W.E. Pratt Manufacturing Co. (Joliet)

In spring 1943, Pratt and its parent company, Joslyn Manufacturing and Supply Co., began machining uranium slugs for the first reactors built at the U. of C. In 1944, Pratt also machined uranium rods for the Metallurgical Laboratory.

• Wycoff Drawn Steel Co. (Chicago)

Machined uranium slugs for the Metallurgical Laboratory in 1943.

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Energy Department officials said the burden will be on the government—not the victim—to track down employment and exposure records.

"In the past, workers had to go through sheer hell to get records," said an Energy Department official who requested anonymity. "Now it won't be that way."

Michaels, assistant energy secretary for environment, safety and health in the Clinton administration, said the effort to identify and compensate injured weapons workers was one of the department's top accomplishments in recent years.

He said, "It's a statement that is saying, 'The Cold War is over; we don't need to deny the risks and unfortunate side effects of nuclear weapons production.'"